

Attendance Problems. Simplify each radical.

1. $\sqrt{12}$

2. $\sqrt{50}$

3. $\sqrt{75}$

Find the distance between each pair of points. Write your answer in simplest radical form.

4. (1, 6) and (-2, 0)

5. (-7, -1) and (-1, 5)

- I can apply similarity properties in the coordinate plane.
- I can use coordinate proof to prove figures similar.

Vocabulary	
dilation	scale factor

Common Core

CC.9-12.G.CO.2 Represent transformations in the plane. Compare transformations that preserve distance and angle to those that do not.

CC.9-12.G.SRT.1 Verify the properties of dilations given by a center and a scale factor:

- a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
- b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

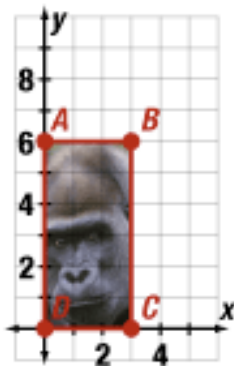
A **dilation** is a transformation that changes the size of a figure but not its shape. The preimage and the image are always similar. A **scale factor** describes how much the figure is enlarged or reduced. For a dilation with scale factor k , you can find the image of a point by multiplying each coordinate by k : $(a, b) \rightarrow (ka, kb)$.

Helpful Hint

If the scale factor of a dilation is greater than 1 ($k > 1$), it is an *enlargement*. If the scale factor is less than 1 ($k < 1$), it is a *reduction*.

Refer to video example 1.

The figure shows the position of a JPEG photo. Draw the border of the photo after a dilation with scale factor $\frac{4}{3}$.



1 Computer Graphics Application

The figure shows the position of a JPEG photo. Draw the border of the photo after a dilation with scale factor $\frac{3}{2}$.

Step 1 Multiply the vertices of the photo $A(0, 0)$, $B(0, 4)$, $C(3, 4)$, and $D(3, 0)$ by $\frac{3}{2}$.

Rectangle
 $ABCD$

Rectangle
 $A'B'C'D'$

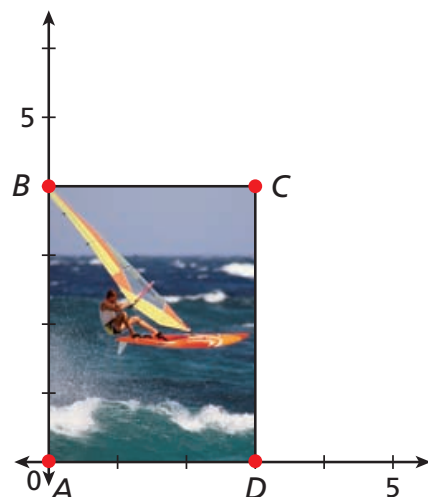
$$A(0, 0) \rightarrow A'\left(0 \cdot \frac{3}{2}, 0 \cdot \frac{3}{2}\right) \rightarrow A'(0, 0)$$

$$B(0, 4) \rightarrow B'\left(0 \cdot \frac{3}{2}, 4 \cdot \frac{3}{2}\right) \rightarrow B'(0, 6)$$

$$C(3, 4) \rightarrow C'\left(3 \cdot \frac{3}{2}, 4 \cdot \frac{3}{2}\right) \rightarrow C'(4.5, 6)$$

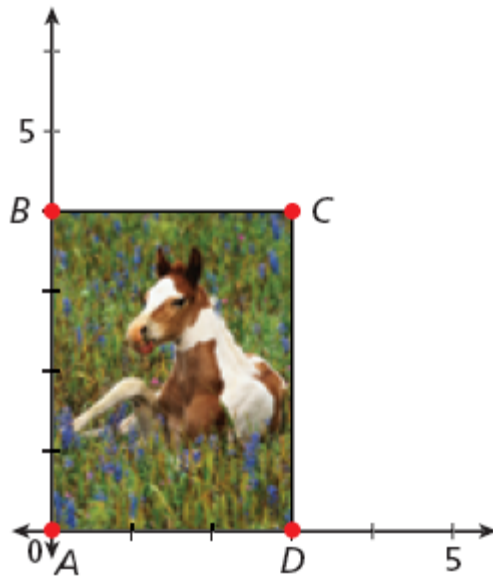
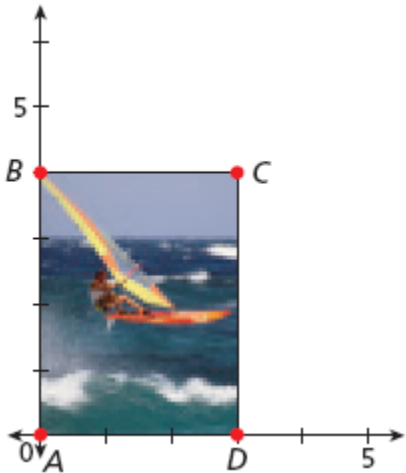
$$D(3, 0) \rightarrow D'\left(3 \cdot \frac{3}{2}, 0 \cdot \frac{3}{2}\right) \rightarrow D'(4.5, 0)$$

Step 2 Plot points $A'(0, 0)$, $B'(0, 6)$, $C'(4.5, 6)$, and $D'(4.5, 0)$. Draw the rectangle.



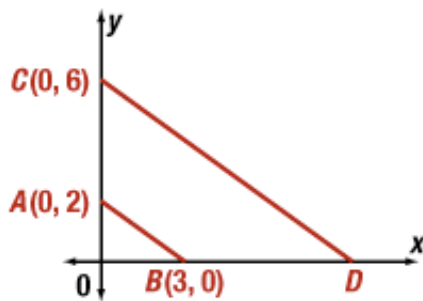
Example 1. Draw the border of the photo after a dilation with scale factor $\frac{5}{2}$.

6. Guided Practice. Draw the border of the original photo after a dilation with scale factor $\frac{1}{2}$.



Refer to video Example 2.

Given that $\triangle AOB \sim \triangle COD$, find the coordinates of D and the scale factor.



2

Finding Coordinates of Similar Triangles

Given that $\triangle AOB \sim \triangle COD$, find the coordinates of D and the scale factor.

Since $\triangle AOB \sim \triangle COD$,

$$\frac{AO}{CO} = \frac{OB}{OD}$$

$$\frac{2}{4} = \frac{3}{OD}$$

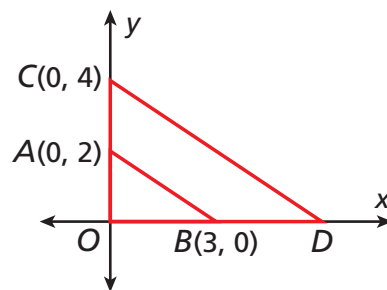
*Substitute 2 for AO, 4 for CO,
and 3 for OB.*

$$2OD = 12 \quad \text{Cross Products Prop.}$$

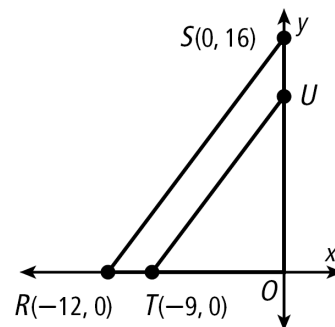
$$OD = 6 \quad \text{Divide both sides by 2.}$$

D lies on the x -axis, so its y -coordinate is 0. Since $OD = 6$, its x -coordinate must be 6. The coordinates of D are $(6, 0)$.

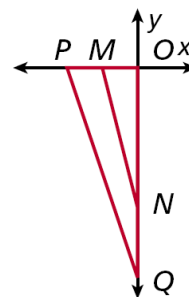
$(3, 0) \rightarrow (3 \cdot 2, 0 \cdot 2) \rightarrow (6, 0)$, so the scale factor is 2.



Example 2. Given that $\triangle TUO \sim \triangle RSO$, find the coordinates of U and the scale factor.



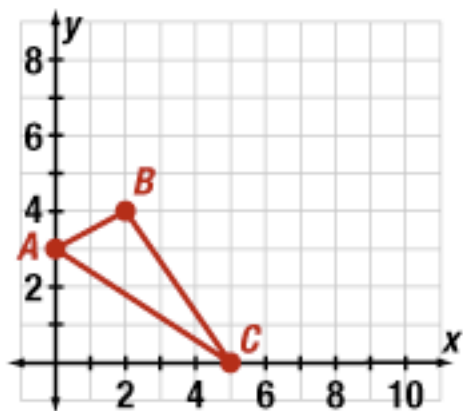
7. Guided Practice. Given that $\triangle MON \sim \triangle POQ$ and coordinates $P(-15, 0)$, $M(-10, 0)$, and $Q(0, -30)$, find the coordinates of N and the scale factor.



Refer to video Example 4.

Graph the image of $\triangle ABC$ after a dilation with scale factor 2.

Verify that $\triangle A'B'C' \sim \triangle ABC$.



4 Using the SSS Similarity Theorem

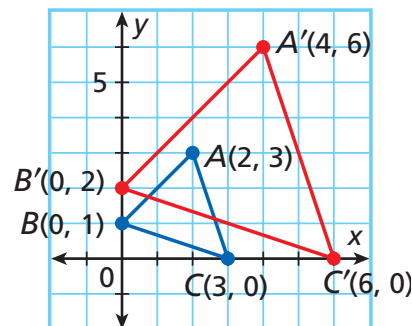
Graph the image of $\triangle ABC$ after a dilation with scale factor 2.
Verify that $\triangle A'B'C' \sim \triangle ABC$.

Step 1 Multiply each coordinate by 2 to find the coordinates of the vertices of $\triangle A'B'C'$.

$$A(2, 3) \rightarrow A'(2 \cdot 2, 3 \cdot 2) = A'(4, 6)$$

$$B(0, 1) \rightarrow B'(0 \cdot 2, 1 \cdot 2) = B'(0, 2)$$

$$C(3, 0) \rightarrow C'(3 \cdot 2, 0 \cdot 2) = C'(6, 0)$$



Step 2 Graph $\triangle A'B'C'$.

Step 3 Use the Distance Formula to find the side lengths.

$$\begin{aligned} AB &= \sqrt{(2-0)^2 + (3-1)^2} \\ &= \sqrt{8} = 2\sqrt{2} \end{aligned}$$

$$\begin{aligned} A'B' &= \sqrt{(4-0)^2 + (6-2)^2} \\ &= \sqrt{32} = 4\sqrt{2} \end{aligned}$$

$$\begin{aligned} BC &= \sqrt{(3-0)^2 + (0-1)^2} \\ &= \sqrt{10} \end{aligned}$$

$$\begin{aligned} B'C' &= \sqrt{(6-0)^2 + (0-2)^2} \\ &= \sqrt{40} = 2\sqrt{10} \end{aligned}$$

$$\begin{aligned} AC &= \sqrt{(3-2)^2 + (0-3)^2} \\ &= \sqrt{10} \end{aligned}$$

$$\begin{aligned} A'C' &= \sqrt{(6-4)^2 + (0-6)^2} \\ &= \sqrt{40} = 2\sqrt{10} \end{aligned}$$

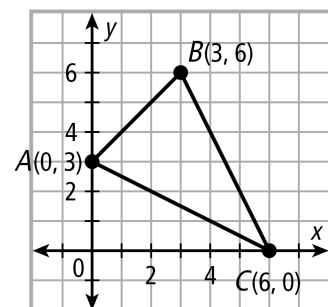
Step 4 Find the similarity ratio.

$$\frac{A'B'}{AB} = \frac{4\sqrt{2}}{2\sqrt{2}} = 2, \quad \frac{B'C'}{BC} = \frac{2\sqrt{10}}{\sqrt{10}} = 2, \quad \frac{A'C'}{AC} = \frac{2\sqrt{10}}{\sqrt{10}} = 2$$

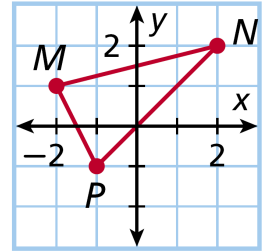
Since $\frac{A'B'}{AB} = \frac{B'C'}{BC} = \frac{A'C'}{AC}$, $\triangle ABC \sim \triangle A'B'C'$ by SSS \sim .

Example 4. Graph the image of $\triangle ABC$ after a dilation with scale factor $\frac{2}{3}$.

Verify that $\triangle A'B'C' \sim \triangle ABC$.



9. Guided Practice. Graph the image of $\triangle MNP$ after a dilation with scale factor 3. Verify that $\triangle M'N'P' \sim \triangle MNP$.



7-6 Dilations and Similarity in the Coordinate Plane

- (p 513) 10-12, 15, 16-20.
- 7B Ready to Go On pretest & posttests.